AGRICULTURAL Research

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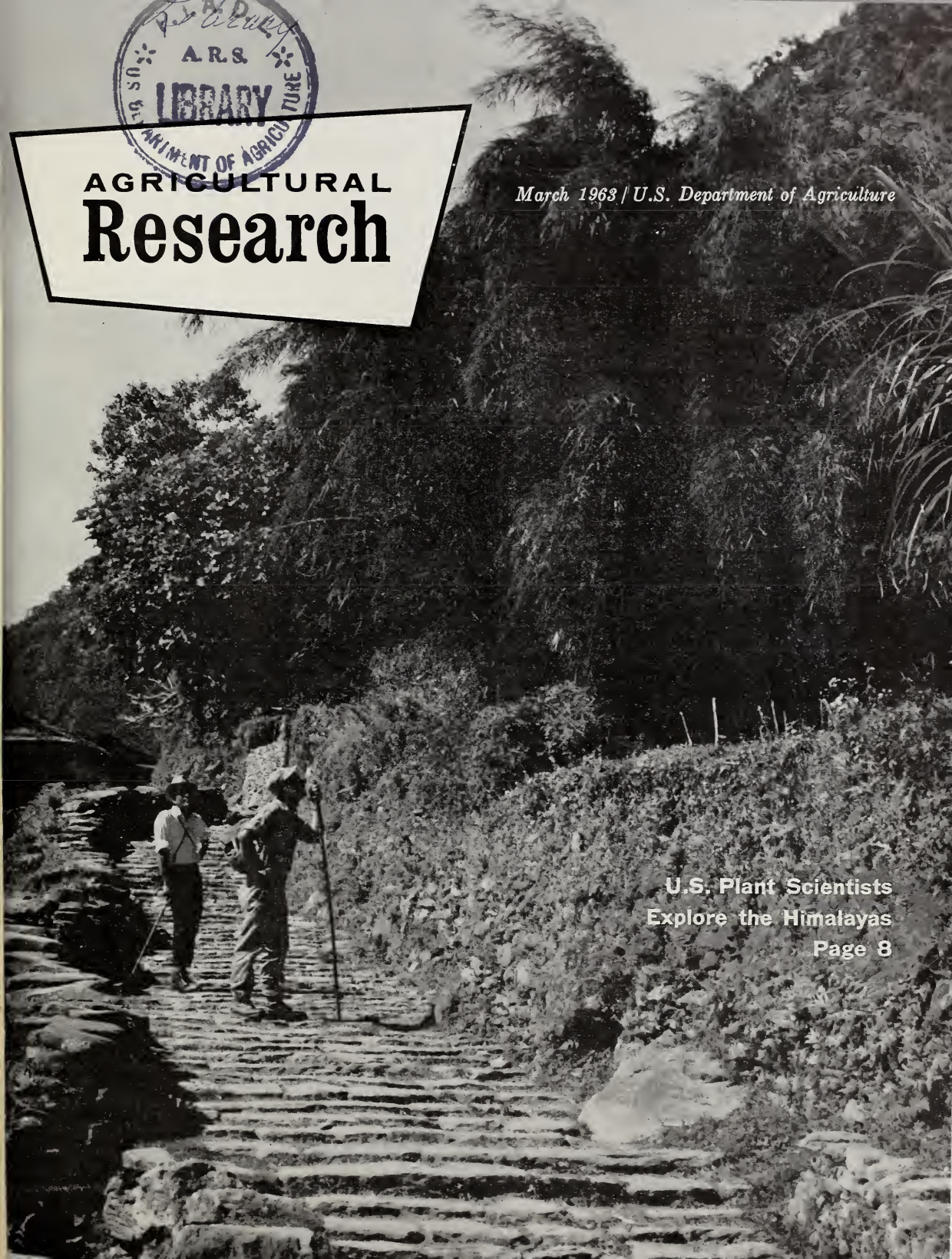

U.S. Plant Scientists Explore the Himalayas
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Plant Exploration

A South American wild yam seems a remote subject to an arthritic patient. But the yam and the patient have a very real common denominator in cortisone, a drug now obtainable from the yam.

An outcome of plant exploration, the wild yam is now being investigated by ARS as a potential new U.S. cultivated crop. Thousands of promising plants of this type are being stockpiled as today's genetic building blocks for tomorrow's crops, trees, and ornamentals.

This genetic stockpile is the basis for a great many dramatic changes in American agriculture: A little wild tomato from Peru carried the genes for wilt resistance that is built into today's commercial tomato varieties . . . . The introduction of soybeans from the Orient established an entirely new agriculturally based U.S. industry . . . . Wheat from Ethiopia provided new sources of resistance to rust 15B that threatened all commercial varieties grown in the Western Hemisphere.

A most promising new crop being introduced by ARS into U.S. agriculture is crambe (*Crambe abyssinica*), native to the Mediterranean region. ARS scientists envision many industrial markets for crambe-seed oil, including its use in the manufacture of synthetic fibers, detergents, plastics, lubricants, and resin paints.

In the past 50 years we have developed a vigorous organization for collecting plants in all parts of the world . . . and maintaining germ plasm in forms that can be used by crop breeders. Nations throughout the world look to the U.S. collection of cereals, for example, which contains virtually unlimited germ plasm in its 16,000 wheats, 8,000 barleys, 4,000 oats, and 3,200 varieties and selections of rice.

As a result of this and other collections, research crop materials now move out from this country at a greater rate than they come in.

Plant disease specialists, soil scientists, agricultural engineers, farmers, processors, and consumers are daily changing their specifications and blueprints for tomorrow's plant varieties. It will be the responsibility of plant explorers and breeders to meet these demands with new and improved crops.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

A report on how the chemosterilant

APHOLATE
Combats Insects

The sterilant causes self-annihilation of houseflies, boll weevils in laboratory and field tests

Experimental success attained with chemicals that sexually sterilize insects has made it vitally important to learn how these chemosterilants do their work. Here is a report on results obtained with one of the leading chemosterilants: APHOLATE.

■ One of the most promising chemosterilants—apholate—now being used successfully in field experiments against insects has been found to inhibit the ovary and egg development of young unmated female houseflies.

In fundamental laboratory work at Orlando, Fla., ARS entomologists P. B. Morgan and G. C. LaBrecque fed a group of newly emerged female flies food containing 1 percent of apholate. A control group of the newly emerged females were given untreated food.

The Orlando research was designed to find out how apholate sterilizes insects. Knowing how chemosterilants work can place scientists in a better position to use the chemicals in practical insect eradication or control.

Research on chemosterilants began less than 10 years ago. The idea of controlling insects by destroying their reproductive powers was conceived by E. F. Knipling, head of ARS entomology research, and R. C. Bushland, head of livestock insects investigation at Kerrville, Tex. ARS scientists first turned to radiation to induce sterility and demonstrated that male screwworm flies could be made sexually sterile by bombarding pupae with gamma rays from cobalt 60. This discovery led to the Federal-State campaign that eradicated this pest from the Southeast in 1958–59. A similar campaign is now underway in the Southwest.

Recognizing the limitations of radiation led ARS scientists to intensive research on chemosterilants. The radiation technique requires elaborate and expensive equipment to rear and sterilize large numbers of insects for release in the field. In contrast, a safe chemosterilant could be used to sterilize native insect populations.

Test insects laid no eggs

In the Orlando research, Morgan and LaBrecque dissected the treated and untreated houseflies at ages varying from 24 to 240 hours and examined the eggs and ovaries under a microscope. Houseflies are capable of depositing eggs within 72 hours after emergence as adults. But by withholding the medium on which insects lay eggs, the scientists prevented the flies from laying eggs throughout the 240 hours.

The first batch of eggs, although not viable, developed to approximately normal size. The second batch appeared stunted. The third batch, normally visible under the microscope

Turn Page

APHOLATE

(Continued)

in 96-hour-old female flies, could not be seen until 168 to 192 hours.

This 73- to 96-hour delay in the development of the third batch of eggs is attributed by the scientists to an inhibiting influence on the germarium (egg-producing part of the ovary). The chemical did not appear to influence ovarian development during the first 48 hours. The effect was noticeable, however, at 72 hours.

Apholate starts inhibiting egg development between 48 and 72 hours after the insect emerges, the entomologists concluded, and it apparently exerts its greatest influence on the second batch of eggs and on the germarium of the third batch.☆

Louisiana experiment, although on a 6-acre test plot, marks the first time boll weevils have been eliminated biologically in the field

Apholate is used to eradicate the boll weevil

■ Boll weevils have been eradicated on a small Louisiana test plot by State and Federal scientists, using the chemical apholate to sterilize the male weevils.

ARS entomologists stress that this significant achievement was attained under ideal field conditions that gave them practically laboratory-type control over the work. It follows earlier experimental success in eradicating houseflies (AGR. RES., November 1961, p. 3, and April 1962, p. 7). These and other developments in research with chemosterilants mark this biological control method as a major breakthrough in the scientific fight against insect pests of man, his animals, and his crops.

Scientists create weevil infestation

The scientists created the boll-weevil infestation on a 6-acre test plot by releasing 10 egg-laying females on July 26, 1962. The plot, planted specifically for the experiment, was located in Plaquemines Parish about 60 miles south of New Orleans and remote from normal cotton fields.

Male boll weevils released on the isolated test site were sterilized in the laboratory by dipping them in the chemosterilant apholate (see preceding story, p. 3). Female weevils that mate with sterile males lay eggs that do not hatch, causing self-destruction of the insect population.

The Louisiana boll weevil test was conducted by ARS entomologists in cooperation with the Louisiana Agricultural Experiment Station. Laboratory experiments leading to the test were conducted at ARS cotton research laboratories at State College, Miss., and College Station, Tex., in cooperation with the State stations.

Release of sterile males began on August 1 and continued through September 19. The weekly release schedule was based on a careful calculation of the egg-laying capabilities of the females in the field.

Egg punctures are recorded

The number of egg punctures in cotton squares and other data were obtained each week. The number of egg-punctured squares reached a peak on August 28, after which it gradually declined until the insects were eradicated (November 15). Follow-up observations showed the test field was free of boll weevils and egg-punctured cotton squares.

The scientists are optimistic that the new chemosterilant technique may ultimately lead to measures for eradicating the boll weevil—most destructive of all cotton insect pests in the U.S. They point out, however, that many problems must be solved in both laboratory and field applications of this technique before a campaign to eradicate boll weevils by sterilization could be considered.☆

Corn yield on covered-ridge plots was double the 10-year average. Corn was planted in rows 42 inches apart between plastic-covered ridges. Soil moisture was measured with equipment lowered through access tubes.

Putting Water Where It's Needed

Plastic-covered ridges divert rainfall into corn rows in semiarid area

By concentrating the limited moisture available, ARS soil scientists demonstrated that 50 bushels of corn per acre can be produced in a drought year, without irrigation, in south-central North Dakota.

The method they used—covering ridges of soil between corn rows with plastic film—is too costly now for farmers. But the research may lead to new moisture-conserving practices for general use on the semiarid Northern Great Plains.

The 50-bushel yield produced in the ARS experiment is twice the average yearly yield on North Dakota farms for the past 10 years. The plastic-film method was tested for 2 years by W. O. Willis, H. J. Haas, and J. S. Robins at the Northern Great Plains Field Station at Mandan. This is about as far north as corn can be grown for grain.

Limits evaporation, boosts infiltration

Crop yields are erratic in this plains area because rainfall often is inadequate or fails to come when growing plants need it most. Scientists are seeking to conserve this limited rainfall by restricting evaporation and increasing infiltration of water into the soil.

In test plots, the scientists formed soil ridges 3 inches high, parallel to the corn rows. Ninety percent of the ridged area was covered with black polyethylene plastic film, and corn was planted in the uncovered furrows between the ridges. The film was 38 inches wide, and the rows were 42 inches apart.

Rainfall drained off the covered ridges and concentrated in the 10 percent of the soil that was bare. Thus, if a ¼-inch rain fell on the plots, the uncovered furrows, where the corn grew, received the equivalent of a 2½-inch rain.

On bare check plots, moisture from a ¼-inch rain was frequently available to plants for only a day before it evaporated. But on the plots with plastic-covered ridges, the concentrated rainfall penetrated deeper. This deeper penetration and the plastic film cover are both effective means of decreasing evaporation loss.

The plastic covering also saved soil moisture between crop seasons. Compared with the bare plots, the covered-ridge plots stored 0.4 inch more moisture in the fall between harvest and freezing and 1 inch more in the spring between thawing and planting.

Covered plots yield more both years

The covered plots yielded more corn both years of the experiment. In 1960, when 12.9 inches of rain fell between May and mid-September, the yield was 55 bushels per acre on covered plots and 41 bushels on uncovered check plots. In 1961, a drought year when only 4.2 inches of rain fell between May and September, the covered plots produced 50 bushels of corn per acre, compared with only 21 bushels on the plots without covering.

The scientists say the increased yields on the covered-ridge plots are the result of (1) more efficient use of light rains, (2) better utilization of the increased soil moisture in corn rows, and (3) higher soil temperature, which stimulated germination and seedling growth.☆

WORKING WIVES

How they manage their households and use their earnings

■ Working wives are now about 60 percent of the women in the U.S. labor force, and the number is increasing each year. Knowing how they manage their households—and how much they contribute to family income—can help other homemakers decide whether outside employment provides worthwhile benefits.

Family economists of ARS, interested especially in the home management practices of working wives, are studying some of the economic effects on the family of the wife's gainful employment.

A recent study in Ohio, conducted in cooperation with the Ohio Agricultural Experiment Station, included both city and rural families and both employed and nonemployed wives. About 15 percent of the working wives were in professional or managerial jobs and another 15 percent were in service occupations. The majority, however, worked in clerical, sales, or industrial jobs.

The ARS scientists report these results from a preliminary analysis of the Ohio study:

Effects on home management

Some of the working wives lightened their homemaking job by hiring help to care for the children or do laundering, general housework, or sewing. Most of those with preschool children (80 percent in the city, 90 percent in the country) hired some help, mainly because care had to be provided for their youngsters. About half of the employed women with only school-age children reported paid help. In all-adult families, half of the employed wives in the city and 38 percent in the country had help.

The cost of paid help averaged $450 for families with children under 6 years old, less than $200 for those with older children only, and roughly $100 for all-adult families. Nonemployed wives who hired help averaged less than $100 for this expense, regardless of the family makeup.

An average of about 18 meals per week were prepared and served in the homes of employed wives, compared with 20 meals in the homes of nonemployed wives. This difference was due mainly to lunches eaten away from home by all-adult families of employed wives.

Meals away from home

The proportion of families eating some meals in restaurants other than at work or school was the same—13 percent—for rural employed and nonemployed wives and city nonemployed wives. But 19 percent of the city employed wives reported their families ate out some of the time.

The ARS family economists also learned that a majority of the women, both employed and nonemployed, still do some baking at home. The biggest difference was noted in the two-person city families, where 44 per-

cent of the working wives did baking, compared with 70 percent of the full-time homemakers.

Effects on family incomes

Lunches at work were bought by about half of both the city and rural women. About a third of the rural women bought between-meal snacks, compared with half of the city women.

The employed wives used some of their earnings to upgrade their wardrobes. Wives with husbands at a given income level spent more for clothing and for personal care when they were gainfully employed. Some of this additional spending was obviously necessary to permit the wife to appear neat and suitably dressed on the job.

By far the largest single job-related expense was income tax. Transportation to and from work was also a major item, on the average. After these and other job-related expenses had been deducted, net incomes of the Ohio wives ranged from about half of their total income for mothers of preschool children to more than 60 percent for wives in households of adults or of adults and older children.

Most wives pool their incomes

Seven of every 10 wives pooled their net income with that of their husbands, two handled it separately, and one pooled part and kept part. The younger wives were more likely to pool their earnings than the older ones—perhaps because the pressure on family income was greater in these growing families.

The uses reported for the unpooled earnings divided into four approximately equal categories: (1) To provide furnishings, equipment, or other household improvements; (2) to help with general living expenses or to buy things for the children; (3) to pay debts or provide savings; and (4) to buy personal items for the wife.☆

From Corn Sugar

NEW INDUSTRIAL GUM

Two percent of the gum in water makes a gelatinlike thickening agent.

■ A new water-soluble gum made from corn sugar is being tested by industry for potential market outlets.

Using a fermentation process developed by ARS utilization scientists, four companies are supplying this experimental gum to industry for further product-development research.

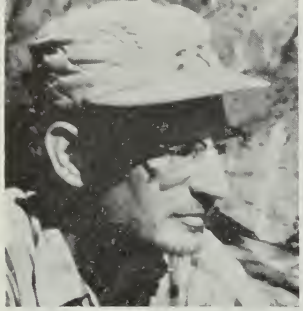
The new corn-sugar product has a distinctive feature. Most gum solutions "thin out" when heated or brought into contact with salts, but the new gum maintains its viscosity under these conditions.

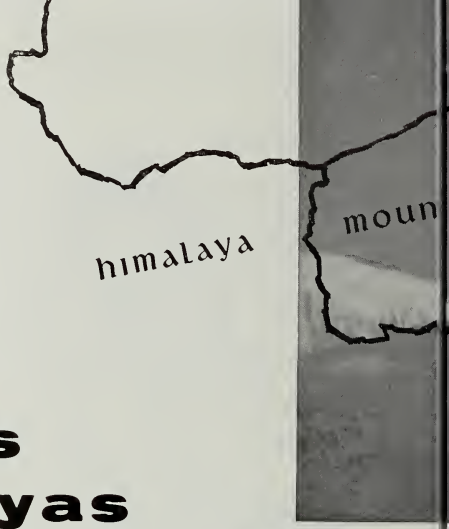
This property and the gum's solubility in water suggest a wide range of possible uses for the product, ARS scientists say. It might be used in oil-well operations—where salt strata and heat are frequently encountered—to control viscosity in drilling and flooding fluids. Flooding fluids are used to drive oil from nearly spent wells.

The gum could improve liquids used in fighting forest fires by increasing the retention of the liquids on leaves and other hard-to-wet surfaces. It could also be used in industrial and food products that contain salts or to thicken foods, pharmaceuticals, and cosmetics such as lotions and shampoos. On the basis of compositional studies, the product apparently is harmless to plants and animals, although its potential food, cosmetic, and pharmaceutical uses will require approval by the Food and Drug Administration.

The fermentation process that produces the gum was developed at the Northern utilization research laboratory, Peoria, Ill., by a team of microbiologists, chemical engineers, and carbohydrate chemists.

The gum is made by the action of a bacterium, *Xanthomonas campestris*, on glucose, or corn sugar, the major ingredient of corn sirup. In addition to glucose, the fermentation medium contains distillers' solubles, minerals, and water. Fermentation for 4 days at 82° F. yields an amount of light-tan material equal to 65 percent of the glucose used. This material is purified, dried, and ground to a soft, bulky powder, which can be stored for long periods. It dissolves completely in cold water. The gum is identified as B–1459, the ARS culture collection number of the micro-organism used in the fermentation process.☆





ARS Himalayan explorers deVos (left) and Creech

U.S. Plant Scientists Explore the Himalayas

First American expedition to Nepal yields hundreds of new exotic ornamentals

■ More than 250 separate collections of exotic ornamentals with rich promise for the U.S. have been brought back from Nepal by two ARS horticulturists, J. L. Creech and F. deVos.

Their trip last fall, which lasted 2½ months, was the first American plant exploration of Nepal. Until a few years ago, the Nepalese Government did not permit foreigners to visit the tiny Asiatic kingdom in the high Himalayas. The Creech-deVos expedition was made in cooperation with Longwood Foundations, Inc., Kennett Square, Pa.

Although Nepal is at the same latitude as Florida, much of the country is at very high elevations. Consequently, any typically southern species found there is of interest in the U.S. because of its unusual hardiness.

Exploring in Nepal must be done almost entirely on foot because the country has only one airline and hardly any roads. Creech and deVos had the help of two Sherpas, Nepal's famed high-altitude porters, and 15 regular porters. The group slept in tents. Food supplies were bought in Katmandu, capital of Nepal, and back packed into the collecting areas.

The expedition made four major treks—all in the west-central part of the little kingdom.☆

Seed pods of the Magnolia Campbellii *(left), a large deciduous magnolia, were found at an altitude of 9,000 feet. It has unusual hardiness. A Sherpa (right) holds the bright scarlet fruit of a cucurbit vine, known botanically as* Trichosanthes palmata. *This vine, closely resembling U.S. gourds, was found at 7,000 feet.*

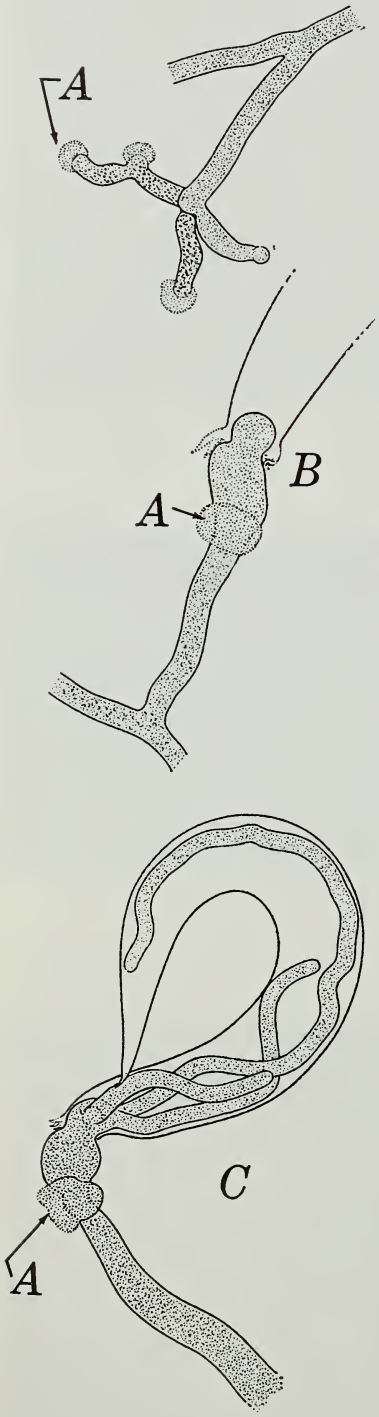
The plant explorers camped at an altitude of 9,000 feet in the foothills of the Annapurna range and explored the Himalayas to 12,000 feet. The exploration sites are indicated on the map of Nepal.

A Sherpa and a Nepalese porter (left) display a fruiting branch of a native silver fir, Abies spectabilis. *The shrub (right), as yet unidentified, is of special interest. It has large, colorful fruit—pink to bluish.*

Resembling the popular philodendron, a member of the Arum family (right) grew in a shaded rocky area near a river bed. Ground orchid (far right) of the genus Pleione *was found growing in carpets as high as 7,600 feet. It was blooming after a light frost. Blossom color is usually orchid—white on rare occasions—with a yellow throat.*

Fungus Captures Nematode

Discovery adds to our basic knowledge on controlling pests biologically



■ Scientists are working toward the day when practical biological controls can be widely used against plant pests. To reach this goal, they need additional basic knowledge.

C. Drechsler, ARS mycologist, recently provided a single piece in the puzzle by identifying a species of fungus that captures and kills soil-inhabiting nematodes. Drechsler, a world authority on predacious fungi, is now retired from USDA.

The new fungus, *Acaulopage pectospora*, is a microscopic organism belonging to a genus of the algalike fungi known as Phycomycetes. The fungus lives by feeding on a nematode (*Bunonema sp.*), a tiny eelworm commonly found in organic soil material. Drechsler found the new fungus in a tuft of moss taken from a moist location.

Fungus secretes sticky substance

The fungus captures its prey with a sticky substance it secretes on knobs borne mostly at the ends of short branches. After trapping the nematode, the fungus quickly develops an extension of the branch and inserts it into the nematode to feed.

Neither the fungus nor its victim has any known economic importance, Drechsler says. Nevertheless, the discovery provides new knowledge about the interrelationships among microscopic soil organisms.

The existence of predacious fungi has been known since the late 19th century. During the last 30 years, many of these species have been identified, about three-fourths of them by Drechsler.

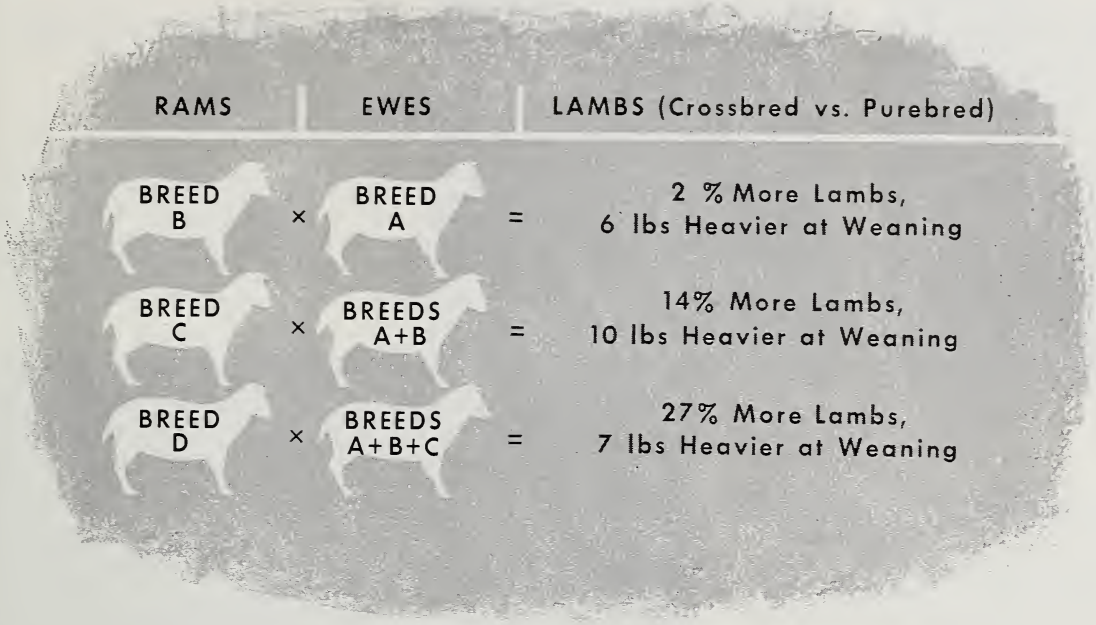
Numerous predator fungi known

Some 60 of those identified capture and kill nematodes, another 30 or so destroy tiny one-celled animals, and at least one captures an insect—a submicroscopic springtail.

Predacious fungi differ from the various species that invade a host and destroy it by infection. Some predacious forms capture their prey with entangling, adhesive networks, and others develop rings with which they strangle nematodes.

A. pectospora is an unusual terresterial fungus, Drechsler says, because its reproductive process at least partly resembles that of a few known aquatic fungi that capture and kill small aquatic animals called rotifers. He found, however, that in the case of *A. pectospora* the asexual spores growing out of the nematode-infested material degenerated under aquatic conditions.☆

The fungus has sticky knoblike organs (A), which adhere to the nematode. Once attached, the fungus grows an extension and inserts it into the nematode (B) to feed. The fungus continues to grow and divide (C) until it completely fills, and gradually digests, the nematode.



More, heavier lambs are weaned in 8-year Beltsville study on . . .

Crossbreeding of Sheep

■ It's common knowledge to sheep producers that crossbreeding yields more and heavier lambs. Many producers get better lamb crops by buying crossbred ewes and mating them to purebred rams.

But how much better are crossbred lamb crops? That's one question ARS scientists are trying to answer in crossbreeding studies at Beltsville, Md. Here are two others:

- What crossbreeding works best?
- What breeds are best to use in crossbreeding for market lambs?

3,000 ewes and 2,500 lambs

Progress toward answering these questions has been made in an 8-year study, by ARS animal husbandman G. M. Sidwell and associates, involving the breeding of nearly 3,000 ewes and weaning of 2,500 lambs.

Two more lambs were weaned per 100 ewes when purebred ewes were mated to rams of a different breed than when rams and ewes of the same breed were mated. The average weaning weight of the crossbred lambs was 6 pounds higher than that of the purebred lambs.

More lambs from crossbred ewes

Bigger increases were gained when crossbred ewes (from dams and sires of different breeds) were mated to rams of a third breed. Compared with purebred matings, this 3-breed combination produced 14 more lambs weaned per 100 ewes bred—and added 10 pounds to the average weaning weight.

Combining four breeds produced an even larger lamb crop—27 more lambs weaned per 100 ewes bred than purebred mating. The average weaning weight was 7 pounds heavier.

The ewes in this part of the study were offspring of 2-breed dams and sires of a third breed; they were mated to rams of a fourth breed.

One of the most successful combinations was obtained by crossing purebred Merino rams with Hampshire - Southdown - Shropshire ewes. This produced 39 more lambs weaned per 100 ewes bred than purebred matings and added 9 pounds to the average weaning weight.

To test the performance of different breeds in crossbreeding, the scientists used various combinations of Hampshires, Merinos, Shropshires, and Southdowns. A strain of Columbia-Southdale crossbreds being developed at Beltsville was also evaluated in the study. The scientists have replaced the Shropshires and Southdowns with Suffolks and Dorsets to get comparisons of more breeds.☆

What Color Light Attracts Weevils?

Scientists use Y-tunnels to find colors most appealing to boll weevils

■ Red, yellow, green, blue . . . what color light does a boll weevil prefer?

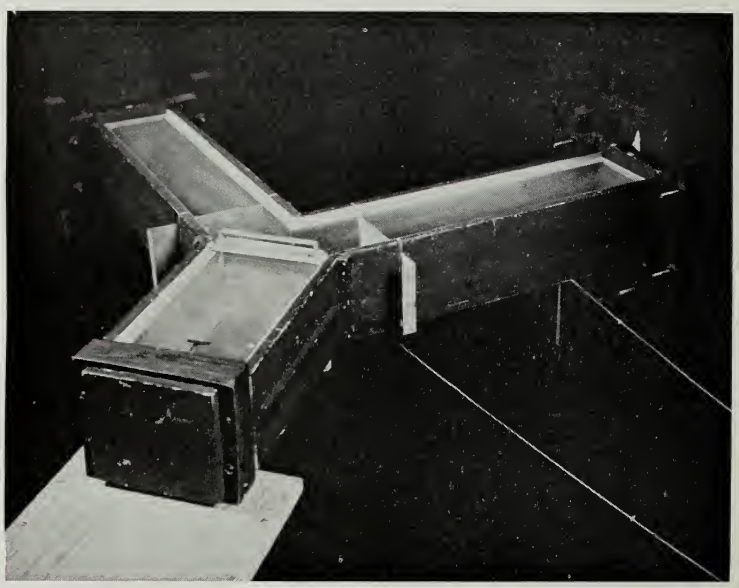
Agricultural engineers and entomologists are seeking the answer in studies of the boll weevil's reaction to light of various colors and intensities. They hope to find a light source that will attract weevils.

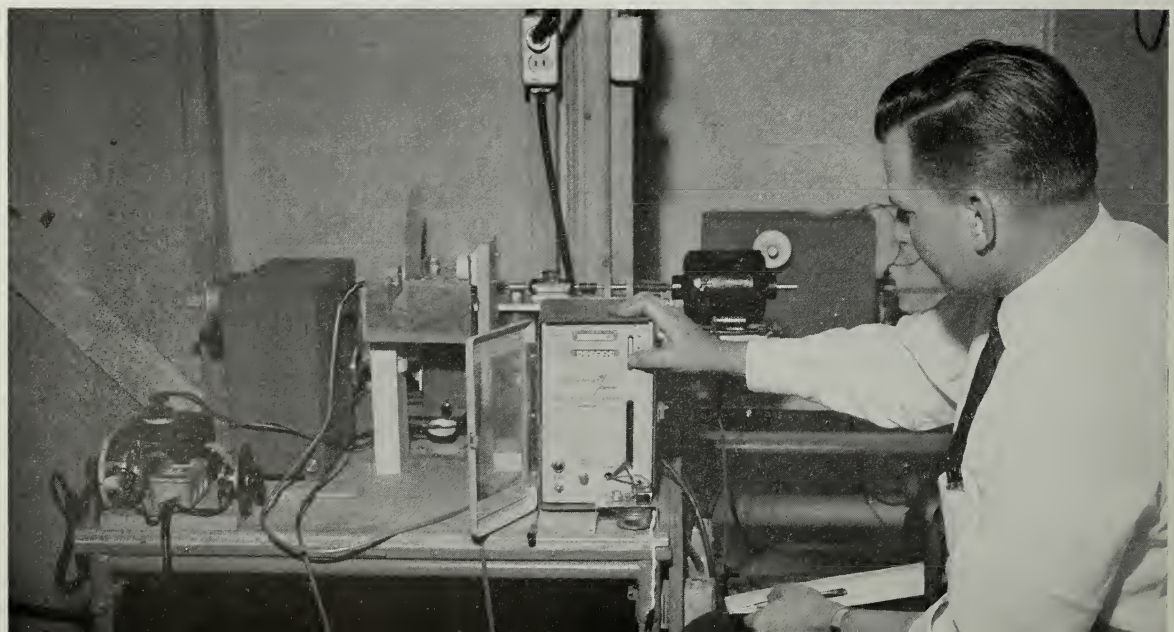
An effective light attractant would give cotton producers another new weapon in their fight against this insect pest, which has destroyed some $10 billion worth of cotton since entering the U.S. in the 1890's. (See AGR. RES., February 1963, p. 10, and p. 4 of this issue, for other new techniques being tested against boll weevils.)

ARS engineer J. P. Hollingsworth and entomologist D. A. Lindquist, working with the Texas Agricultural Experiment Station, State College, are exposing mature boll weevils to precisely measured light in a Y-tunnel.

About 40 adult weevils are put in the base of the Y, and at the end of each arm of the Y is a light of different color and intensity. After about 10 minutes, the scientists check to see which light attracted more weevils.

Hollingsworth and Lindquist have thus far been working with visible light in the near ultraviolet region of the spectrum (wavelengths of 315 to 665 millimicrons). In these tests, weevils have responded best to blue-green light at about 500 millimicrons. The scientists plan to test light in



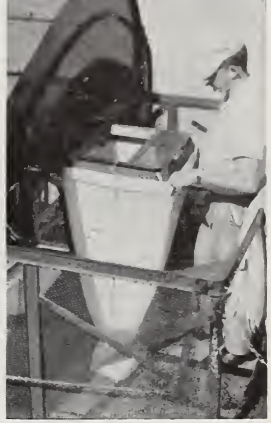


other parts of the spectrum also.

A similar but larger Y-shaped tunnel has been designed and built recently by ARS engineer E. C. Burt at the Boll Weevil Research Laboratory, State College, Miss. Burt, who is working with entomologists of the Mississippi Agricultural Experiment Station. is starting tests of the response of weevils to wavelengths of light ranging from 400 millimicrons (blue) to 1,100 millimicrons (infrared).☆

LOWER LEFT—J. P. Hollingsworth checks two monochromators used to produce and measure the amount of color and light to which boll weevils are exposed in a Y-shaped tunnel (top left), located in an adjacent room. Each monochromator is connected to an arm of the Y-tunnel.

BELOW—A more complex Y-tunnel is employed by E. C. Burt to study the effects of light on boll weevils. Burt immobilizes the weevils with CO_2, then collects them from an arm of the tunnel for counting.



Cotton test plots are picked quickly and uniformly by this mechanical picker, equipped with a turntable that holds four detachable sacks. Sacks are rotated manually.

Cotton Plot Picking . . . Nonstop

■ An ARS-developed cottonpicker attachment makes possible nonstop mechanical picking of cotton in test plots.

With this attachment, a mechanical picker harvests as much cotton in 1 minute as a hand picker harvests in 90 minutes. And the mechanically harvested cotton is more uniform in quality—an important consideration to scientists evaluating experimental cotton strains.

The attachment consists of a turntable and a discharge duct, installed on a 1-row mechanical cottonpicker. It can be installed in about 20 minutes by removing the top of the picker basket and fastening the turntable in place with six bolts. The turntable holds four detachable sacks, each numbered to correspond with a plot row.

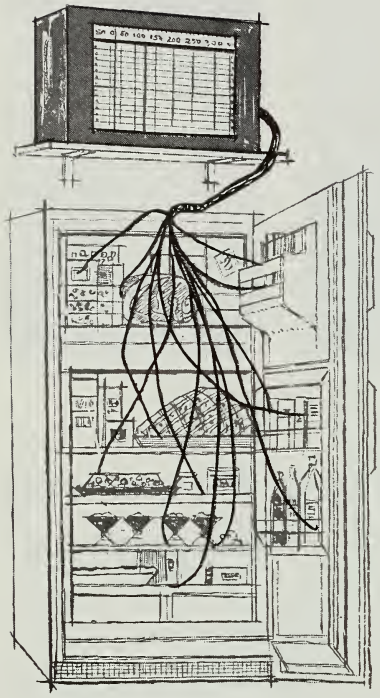
As the picker moves through the plots, the harvested cotton is blown through the discharge duct into one of the sacks. When the machine reaches the end of a row, the turntable is manually rotated to the next sack. The full sack is removed and hung on the side of the picker, and another sack is installed in its place.

After several plot rows, up to 100 feet long, are harvested, the full sacks are unloaded, and the cotton is checked for yield, quality, insect damage, and other characteristics.

Fast, uniform picking is needed in harvesting experimental cotton. Several days are often required for hand picking, and during this time the quality of the cotton changes. Also, hand pickers gather varying amounts of trash and often leave many bolls on the plants. The faster, more automatic picking largely avoids these problems.

The picker attachment was developed by ARS agricultural engineers J. E. Clayton and O. B. Wooten and agronomist J. T. Holstun at the Cotton Mechanization Research Laboratory, Stoneville, Miss. They worked in cooperation with the Mississippi Agricultural Experiment Station.

The new attachment is not commercially available, but plans can be obtained from the Stoneville laboratory.☆



Refrigerators and refrigerator-freezers were loaded with simulated food packages according to standard procedure and subjected to normal home-use conditions. Temperatures were recorded automatically, day and night.

How Good Is Your Frozen-Food Storage?

Specialists study refrigerators and refrigerator-freezers

■ Homemakers should keep a watchful eye on frozen foods stored in conventional refrigerators, an ARS study shows.

Frozen-food quality can be maintained for long periods in the cold-storage areas of most combination refrigerator-freezers. But it deteriorates after only a few days of storage in a conventional refrigerator's ice-cube compartment.

Previous research has established that home freezers are satisfactory for storage of frozen foods if control settings hold the temperature at 0° F. or lower and if packaging and other prescribed conditions are followed. Even under optimum conditions, however, the maximum storage time varies for different types of food. For example, ice cream should not be stored more than a month, but fruits can be stored for a year.

In the recent research, conducted at Beltsville, Md., household equipment specialists E. C McCracken and F. Churchill studied frozen-food storage conditions in conventional refrigerators and combination refrigerator-freezers (both gas and electric).

Quality maintained only a few days

In the conventional refrigerators, the temperature in the ice-cube compartment was low enough to maintain frozen-food quality for only a few days, even when the temperature in the general-storage unit was reduced to the lowest practical point, 32° F. At this low temperature, however, some of the foods in the general-storage area froze.

If frozen food must be stored temporarily in a conventional refrigerator, the equipment specialists say, obviously the best temperature setting is the lowest that will not cause freezing in the general-storage compartment.

Cold-storage areas of most of the refrigerator-freezers were satisfactory for maintaining quality in frozen foods. The scientists noted, however, that the temperature of food packages stored on door shelves of the freezers was higher than that of food in the main freezer compartments. (All 2-door refrigerator-freezers tested had shelves on the freezer door.)

Frost-free type excels

The unit with the smallest temperature difference between the main compartment and the door was the frost-free type, in which cold air is blown into the freezer compartment. These frost-free cabinets, the researchers found, maintained a more uniform temperature in the entire storage space than the other types.

To maintain the best frozen-food quality, the temperature in refrigerator-freezers, like that in conventional refrigerators, should be kept as low as possible without freezing food in the general-storage area.

The study also revealed that—

• Placing unfrozen or relatively warm (25° F.) frozen packages in cold-storage areas causes little change in the average temperature of frozen foods already stored, if the new packages do not touch the stored packages.

• Placing warm loads in the general-storage area of conventional refrigerators raises the temperature there, but it does not appreciably affect the temperature in the cold-storage area.

• Opening the door of a conventional refrigerator for a short time (up to 10 minutes) actually lowers the temperature in the cold-storage area because the resulting temperature rise in the general-storage area activates the thermostat.

• During defrosting, frozen-food packages left in the cold-storage area of pushbutton-defrosting conventional refrigerators showed a greater temperature rise than packages that were removed from manual-defrosting models, placed in containers, and covered to keep out warm air.☆

AGRISEARCH NOTES

Homegrown foods aid low income

It takes a little digging to raise food for a family. But home-produced food is valuable, both in nutrition and in dollars and cents. This is proved by a survey, of interest to Rural Areas Development, conducted by ARS family economists in five low-income rural counties of Kentucky.

The survey showed that growing food for home use helps low-income farm families have a better diet at less cost. The money saved can be used for education, home furnishings and equipment, better housing, and other things that add up to higher living standards—the main object of RAD.

Modern technology has brought about many changes in farm-family living. One is the shift from producing food at home to buying more at the grocery store. Numerous families have made the shift; but many rural people still cannot earn enough money to buy the food they need and have enough left to buy other family necessities.

An obvious answer is more cash income for these families. This is being made possible by RAD in many rural communities through the development of new industries and the training or retraining of local people for industrial employment.

There are communities and families, however, that cannot make this kind of change easily. Some areas are not suitable locations for industry, and families may be reluctant to leave their home communities to work elsewhere. Some of the family members are unable to work in industry because of advanced age or physical handicap. The benefits of training programs, furthermore, are not reaching all who are in need of vocational help. These people would find it difficult to adjust to the low-income city living if they entered industry as untrained labor.

The Kentucky survey showed that home gardens, home food preservation, and other food production are important to this group of rural people. Besides the economic contribution and the better diet, home production of food offers an opportunity for constructive use of time and energy to those who cannot earn hourly wages.

The average yearly income of families in the five rural counties was about $2,100. The farm families grew half and the nonfarm families grew a fifth of their food supply. Families with money incomes under $1,500 (40 percent of those surveyed) produced food worth $453. This was about half of the value ($892) of their total food supply.

On the average, farm families produced $625 worth of their food, and nonfarm families produced $155 worth. These homegrown foods included meat, milk, poultry, eggs, vegetables, and fruit—all nutritious and all costly to buy.

Mobile air conditioner for sows

A room-type air conditioner has been modified to keep farrowing sows cool in hot weather at the Agricultural Research Center, Beltsville, Md.

Four flexible ducts, 4 inches in diameter, carry cooled air from the conditioner to sows in farrowing pens. These cloth-and-spring ducts are connected to a plywood frame covering the cooler's air outlet.

The mobile unit, which is mounted on a table equipped with wheels, can be used to cool four sows simultaneously. The Beltsville breeding schedule makes it inevitable that a few sows will farrow on the warmest summer

days. Some of these have died.

ARS animal husbandman J. W. Stevenson says cool air from the 220-volt unit helps prevent heat stress in laboring sows. During the two summers the air conditioning unit has been used, no sows have died because of heat stress.

Breeders repeat age-old lily cross

A question that has puzzled lily breeders for nearly 100 years has been answered by ARS horticulturists.

The question: Why—with very rare exceptions—hasn't it been possible to duplicate a cross made in 1869, between the lily species *Lilium speciosum* and *L. auratum*, and produce viable seed?

The answer, revealed in studies by S. L. Emsweller, S. Asen, and J. Uhring at Beltsville, Md., is that seeds produced by crossing the two species normally contain large amounts of water soluble acids. One of these, ferulic acid, has been identified as a growth inhibitor.

By isolating and removing the water soluble acids, the researchers have been able to produce many of the desired lily hybrids. Selected hybrids are now being propagated for

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distribution to commercial growers.

The first hybrid, which had very large, deep-red flowers, was produced by the American historian Francis Parkman. Disease destroyed the bulbs produced from this single plant, but a painting of the flowers stimulated many people to try to reproduce the cross.

When the ARS scientists first tried to cross the two lily species, many seeds were produced but none germinated. A second series of crosses developed several thousand seeds, but only three of these produced plants. All of the plants closely resembled the Parkman hybrid.

In trying to find out why most of the seeds failed to germinate, the scientists dissected some of the seeds and noted that the embryos were in various stages of decomposition. This indicated that some substance in the seeds had destroyed the embryos.

The scientists found that ferulic acid, along with p-coumaric and sinapic acids, could be removed by washing the hybrid seeds in running water for 10 to 14 hours. This broke the deadlock in producing the hybrid lilies. Once the growth inhibitor had been removed, the seeds could germinate and develop normally.

Survey compares citrus hardiness

Sweet orange and mandarin trees weathered the January 1962 freeze in the Rio Grande Valley of Texas better than grapefruit and lemon trees.

An ARS report, which is based on a survey made last spring, describes the effects of the freeze on 23 citrus varieties. The survey was made by R. H. Young, plant physiologist, and E. O. Olson, plant pathologist, both of ARS, in cooperation with the Texas Agricultural Experiment Station and Rio Farms, Inc., of Monte Alto, Tex.

Navel and Valencia orange trees sustained somewhat less wood injury than Jaffa, Marrs, and Hamlin trees in the same groves. Jaffa and Marrs showed varying degrees of injury, however.

Among the Valencia varieties, Frost, Olinda, Campbell, and Cutter had about the same amount of damage to tree wood, but no trees of the Frost variety were killed. The Valencias that were 3, 8, and 12 years old showed comparatively good cold hardiness, but those 27 to 30 years old were more sensitive to the cold.

These older trees had been badly damaged by a freeze in 1951.

A notable exception to the cold hardiness of sweet oranges was a group of Texas navels 27 to 30 years old. These sustained even more damage than Red Blush and Marsh White grapefruit trees in the same age range.

Among mandarin varieties, Clementine and Bruce trees showed much less injury than Bell and Dancy. Both 3- and 12-year-old Dancys were very cold sensitive. This was surprising, because the Dancy mandarin was reported as very cold hardy during earlier freezes.

Frost Eureka and Meyer lemons and Mexican limes proved to be extremely cold sensitive during the freeze. Most of these trees were killed to the ground.

Lily hybrid (center) is a cross between L. speciosum *(left)*, L. auratum *(right)*.

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